

# **HARD TONNEAU COVER**

## **Cross Reference to Related Applications**

This invention claims the benefit of U.S. provisional Serial No. 60/455,999, filed February 7, 2003.

## **Background of the Invention**

This invention concerns hard cover tonneaus for the cargo box of pick-up trucks. In such tonneau covers, one or more panel sections are mounted on the side walls of the cargo box, and are hinged to allow raising of one end or side of the cover sections which may also be disconnected from the cargo box for removal. Such covers have typically been specifically been designed for a particular cargo bed configuration, and have involved heavy panels of fiber glass reinforced molded resins.

Such hard covers are typically fit over plastic protection covers on the cargo box, and hinged to be raised for access to the cargo area, with gas struts used to support the weight of the opened cover.

The heavy weight of these tonneau covers has been an increasing disadvantage as this reduces fuel economy and truck net payload capacity.

The proliferation of pick-up truck cargo box configurations has led to increased costs due to the need for a greater number of custom designed covers.

U.S. patent 6,082,806 suggests a construction using a tubular frame and thin panels fixed to the frame, allowing easy modification to fit various cargo bed sizes.

However, such an approach requires painting of the aluminum frame. The cover

1 panel affixed to the frame is subject to buckling due to temperature induced expansion and is  
2 difficult to replace if damaged.

3 It would be desirable to be able to match the quality of cover finish to vehicle  
4 finish, but this has heretofore not been possible due to the difficulty in obtaining a distortion free  
5 cover surface acceptable to the automobile manufacturers.

6 Another difficulty has to do with the service wear on the components and the  
7 mating sheet metal surfaces due to the severe deflections of the cargo box during driving of the  
8 truck, particularly over rough roads and long periods of time. Such wear occurs in the striker  
9 bars and hinges, and also where a cover seal scrubs against the cargo box painted sheet metal.

10 Another problem is found in draining water from the cover to prevent leakage into  
11 the cargo box. While attempts have been made to seal all the joints, some seepage still occurs,  
12 and any bonding of a cover panel needed to create a seal will create thermally induced distortions  
13 as mentioned above.

14 Installation and removal of the tonneau cover is often time consuming due to the  
15 need to accurately align the cover with the cargo box and the need for installing or removing  
16 numerous cover mounting components and fasteners.

17 It is the object of the present invention to provide a hard tonneau cover for a pick-  
18 up truck cargo box which is light weight and low in cost to manufacture, but which has a high  
19 quality appearance compatible with the factory finish of the truck body.

20 It is another object of the present invention to provide a tonneau cover which can  
21 be readily sized and configured to be matched to a great variety of cargo box sizes and  
22 configurations, and having an easily adjustable mounting system so that the cover may be readily

1 installed in the proper position on the cargo box.

2 It is a further object to provide a hard tonneau cover which can withstand  
3 extended service in the field while maintaining proper function of the components, and a good  
4 appearance while avoiding excessive wear of the truck body finish.

5 Yet another object is to provide a hard tonneau cover which incorporates a water  
6 drainage system which directs water off the cover to prevent any water from penetrating into the  
7 cargo box, and which channels any seepage along a path formed in the cover components away  
8 from the cargo area.

#### 9 10 Summary of the Invention

11 The above recited objects and other objects which will become apparent upon a  
12 reading of the following specification and claims are achieved by a hard tonneau cover including  
13 a frame made up of a series of perimeter rails which can be cut to a selected size and assembled  
14 together into a rectangular framework using corner pieces affixed to adjoining ends of rails  
15 defining each corner. The perimeter rails are provided with inwardly protruding panel support  
16 ledges with an adjacent outer channel.

17 A rectangular panel sized to rest atop the support ledge of the perimeter rails is  
18 nonfixedly held on the framework with an edge clearance space allowing for thermal expansion.  
19 The panel is preferably constructed from an "S-flute" corrugated plastic core having additional  
20 strengthening thin sheets of a suitable plastic or resin laminated onto each face. A covering color  
21 integrated plastic film providing a desired color and finish is loose lay installed over the  
22 reinforced core to achieve an OEM compatible finish. Alternatively, the film can be bonded to

1 the panel.

2 The perimeter rails are also each formed with one or more longitudinal outer slots  
3 which can slidably receive a one or two colored plastic trim strips extending along and covering  
4 each rail so that the rails need not be painted.

5 The trim strips each include an inwardly extending lip overlying the perimeter of  
6 the panel to nonfixedly secure the panel in position be and sealed against the panel. A skirt  
7 portion of a single trim strip or a separate trim strip extends downwardly below the perimeter rail  
8 and outside the cargo box engaging peripheral seal extending along the bottom of the perimeter  
9 rail so that a finished appearance is presented.

10 A matching molded plastic corner is attached to framework corner pieces at the  
11 outer corners of the rail framework, the corner overlapping the trim strips at the corners and  
12 securing the trim strips in place.

13 The perimeter rails and corner pieces also are each formed with a longitudinal  
14 lower slot which receives a top bead on the elastomeric peripheral seal which has a pair of spaced  
15 ribs engaging the cargo box surfaces to create a seal which is sufficiently compressible to  
16 accommodate tilt-up of the tonneau cover, and which prevents entrance of dirt. The ribs are  
17 maintained in contact with the cargo box surfaces to prevent scrubbing.

18 The panel supporting perimeter rail ledge has a downwardly facing tee slot  
19 underneath which receives bolt heads for mounting support brackets for hinges, latches, gas strut  
20 mounts, and connections to crossing rails and struts, anchor brackets, etc.

21 One or more crossing rails and struts extend between the perimeter rails at  
22 adjustably set positions by means of connector plates receiving bolts retained in perimeter rail tee

1 slots and nuts, creating a sturdy but light weight framework for supporting the panel. A central  
2 rail extends in a lengthwise direction from a perimeter end rail to a crossing rail, and the crossing  
3 struts are mounted thereto and to an adjacent perimeter side rail.

4 Both the central and crossing rails may be of an extrusion of identical cross  
5 section.

6 A series of universal clamp-on hinge latch fittings mount to the lip of the cargo  
7 box walls at any selected position, while mating strikers or hinges are attached by a cover bracket  
8 to the perimeter rails using bolts on the ledge rail slots having head received. The same brackets  
9 bolted to the perimeter are used to connect crossing slots in rails to the perimeter rails by bolts  
10 held in slots in the crossing rails. Quick disconnect hinge pins and strikers attach the cover to the  
11 cargo box by being mated to hinge brackets and latch assemblies on the cover.

12 The perimeter rails have water channels receiving water seepage passing the trim  
13 strips overlying the panel perimeter and direct the same down to the corner pieces, which also  
14 receive water passing beneath the corners, the water passing down a descending contour of the  
15 corner pieces to drain out at a point past the peripheral seal.

16 The tonneau cover can be configured in various ways, such as with two raisable  
17 cover sections, each section with separate rail frameworks. In this configuration, a fixed center  
18 section divides the cargo box into two areas, each occupied by front and rear cover sections. The  
19 rear cover section in this design may be hinged to the fixed center section by two hinge  
20 assemblies allowing the rear cover section to be raised up.

21 The forward panel section may be tilted up on one side by the clamp on hinge and  
22 latch brackets.

1 Gas struts are mounted to brackets secured to the cover section rails and a clamp  
2 on brackets on the cargo box to hold the cover in a raised position.

3 Trim strips are mated to slots in either side of the fixed center section which  
4 overly the adjacent edges of the panel of the front and rear cover sections which also are each  
5 formed as transverse water drain gutters which extend to end covers and a cup piece to drain  
6 water passing out from the channels past the perimeter of the cargo box seal.

7 The crossing rails are bowed to create a crowning of the cover to insure rapid  
8 draining of water from the cover.

9  
10 Description of the Drawings

11 Figure 1 is a pictorial view of a hard tonneau cover using two openable and one  
12 fixed cover sections according to the invention shown installed on the cargo box of a pick-up  
13 truck depicted in phantom lines.

14 Figure 2 is a pictorial view of the hard tonneau cover system shown in Figure 1  
15 with the rear cover section in a tilted up position.

16 Figure 3 is a pictorial view of the hard tonneau cover system shown in Figures 1  
17 and 2 with the front cover section shown tilted up from the right side.

18 Figure 4 is a pictorial view of the hard tonneau cover with the rear cover section  
19 tilted up on hinges connected to a fixed.

20 Figure 5 is a pictorial view of another embodiment of the hard tonneau cover  
21 according to the invention shown with a single openable cover section and a tool box mounted  
22 forwardly therefrom.

1               Figure 6 is a pictorial view of a single cover section tonneau cover according to  
2 the invention.

3               Figure 7 is a sectional view of a portion of a cover section of the hard tonneau  
4 cover according to the invention showing a striker installation on a universal mounting bracket  
5 and a mating latch mechanism mounted side thereof.

6               Figure 8 is a sectional view of a rear portion of a raised cover section of the hard  
7 tonneau cover showing a hinge mounted on a universal clamp on bracket, and a connection of a  
8 crossing rail to a perimeter rail by a support connection bracket.

9               Figure 9 is a sectional view of a rear portion of a cover section of the hard tonneau  
10 cover showing a striker on a universal mount disengaged with a latch mechanism on a cover  
11 section.

12              Figure 10 is a view of the middle of a cross section taken through a three section  
13 hard tonneau cover according to the invention, with the rear cover section shown in phantom  
14 lines in a swung up position.

15              Figure 11 is a plan view of a framework used in a three section hard tonneau  
16 cover according to the invention.

17              Figure 12 is an exploded perspective fragmentary view of a connection between  
18 two main support rails included in the framework shown in Figure 11.

19              Figure 13 is an exploded perspective fragmentary view of a connection between a  
20 strut rail and a central crossing rail included in the framework shown in Figure 11.

21              Figure 14 is an exploded pictorial view of a universal clamp on bracket and a  
22 striker assembly components mounted thereto.

1               Figure 15 is an enlarged reverse exploded pictorial view of the striker assembly  
2 components shown in Figure 14.

3               Figure 16 is a pictorial view of the striker assembly shown in Figures 14 and 15.

4               Figure 17 is a fragmentary exploded view of tonneau cover components at one  
5 corner.

6               Figure 18 is a fragmentary exploded pictorial view of trim components included at  
7 the junction of the front, center, rear cover section of a three section tonneau cover according to  
8 the invention.

9               Figure 19 is a fragmentary assembled view of portions of the components shown  
10 in Figure 18 with a water drainage path indicated by a series of arrows.

11              Figure 20 is an enlarged fragmented cross sectional view through the hard tonneau  
12 cover combined with a tool box shown in Figure 5.

13              Figure 21 is a partially exploded pictorial view of one corner of a tonneau cover  
14 according to the invention showing a water drainage path by a series of arrows.

15              Figure 22 is a fragmentary view of some of the hard tonneau cover components at  
16 the rear edge showing a water drainage path by a series of arrows.

17              Figure 23 is an enlarged sectional view of the full peripheral seal included in the  
18 hard tonneau cover according to the invention.

19              Figure 24 is a pictorial view of the cargo box brackets used to mount the tonneau  
20 cover to the cargo box.

21              Figure 25 is a plan view of the brackets and components shown in Figure 24 with  
22 a representation of the cargo box perimeter.



1                Figures 26A, 26B, 26C are side views of an angle piece part of a universal clamp  
2                on bracket with a hinge, striker, and gas strut anchor shown respectively installed thereon.

3                Figure 27 is an exploded sectional fragmentary view of a panel incorporated in the  
4                hard tonneau cover system according to the invention.

5                Figure 28 is an exploded pictorial view of components of one section of a tonneau  
6                cover with a panel removed therefrom.

7                Figure 29 is a pictorial view of the peripheral seal and auxiliary seal and  
8                components incorporated in the tonneau cover according to the invention.

9                Figure 30 is a plan view of a lock assembly used to operate the latch mechanism  
10              included in the hard tonneau cover according to the invention.

11  
12              Detailed Description

13              In the following detailed description, certain specific terminology will be  
14              employed for the sake of clarity and a particular embodiment described in accordance with the  
15              requirements of 35 USC 112, but it is to be understood that the same is not intended to be  
16              limiting and should not be so construed inasmuch as the invention is capable of taking many  
17              forms and variations within the scope of the appended claims.

18              Referring to drawing Figures 1-5, the present invention comprises a hard tonneau  
19              cover, in which a substantially rigid covering is provided for pick-up cargo box depicted in  
20              phantom lines.

21              The tonneau cover may be in multiple sections as for example, the three section  
22              cover 10 shown in Figures 1 and 2, which includes the separately hinged rear cover section 12

1 and forward cover section 14. The rear cover section 12 is mounted on hinges (described below)  
2 at the rear side of a fixed center section 16 lying between the two cover sections 12, 14 so as to  
3 be able to be tilted up as seen in Figure 2, with gas struts 20 used to hold the rear cover section  
4 12 in the up position shown.

5 The forward cover section 14 is mounted by hinge pin assemblies 22 having hinge  
6 pins received in brackets mounted either side of the cargo box by a clamp on mount as will be  
7 described in detail hereinafter, so as to be readily installed in switchable positions to be able to be  
8 tilted up on either the left or right side, as seen in Figures 3 or 4.

9 Latch-striker assemblies not shown in Figures 1-6 secure the cover section sides  
10 opposite the hinges, with the strikers also mounted to the cargo box using the universal mounting  
11 as is described in detail below. A single gas strut 20 is used to hold the forward cover section  
12 open.

13 Figure 5 shows a larger single openable section cover 24, having a single cover  
14 section 26 hinged to a fixed central section 28 along a forward side. A tool box 30 is installed in  
15 the cargo box area forward of the fixed section 28.

16 Figure 6 shows a cover 24A with a larger single openable section 26A and a fixed  
17 section 28A.

18 Other cover arrangements are also possible such as a side hinged rear section (not  
19 shown).

20 Figure 7 shows some of the construction details of the tonneau cover 10. An  
21 extruded aluminum perimeter rail 32A, 32B is included in a forward section of a cover  
22 framework to be described which supports an overlying stiff but resiliently bendable panel 34B

1 without a fixed attachment to allow thermal expansion of the panel and to allow easy removal  
2 and replacement.

3 The perimeter rails, including the side perimeter rails 32A, 32B of the forward  
4 cover section 12, are formed with various features allowing interconnection with other  
5 framework members, a mounting of other components, as well as a support for the panel 34B.

6 As seen in Figure 11, two center crossing rails 94A, 94B and struts 136 are used  
7 to increase the weight sustainable by the cover. Additional crossing rails and/or struts could be  
8 added to increase this capability.

9 All of the perimeter rails 32A, 32B, 96A, 96B, 190, 134 of the cover framework  
10 (Figure 11) are preferably of an identical section.

11 The perimeter rail features include an inwardly extending ledge 36 (Figure 7)  
12 having an upper surface 38 on which an edge of the panel 34B rests, to be nonfixedly supported  
13 thereby. A tee slot 40 is formed underneath the panel supporting surface 38 configured to  
14 slidably receive a making feature formed on support-connector piece 42.

15 The support-connector piece 42 can be located at any desired location along the  
16 slot 40 and secured thereat with bolts 44 and nuts 46.

17 The connector-support pieces 42 may serve several purposes, i.e., to mount an  
18 upper hinge component 45 on the cover, to connect cargo box crossing rails 94A, 94B, 98 and  
19 112 to a perimeter rail 190, 32A, 32B, 96A, 96B and 134 at the junction thereof, to mount latch  
20 assemblies and gas strut rod anchors to the framework. The connector-support pieces 42 have an  
21 extension 43 which can be angled down when used to mount other components to provide easier  
22 access to the fasteners.

1 In Figure 8, a latching assembly 48 is mounted at the free end of a support  
2 extension 43, operated by a cable 50 held on a bracket 52 also attached with bolts 54 and nuts 56.

3 The latching assembly 48 is engageable with a striker assembly 58 mounted to the  
4 lip of a cargo box structure 60 by a clamp on universal mounting bracket 62 described below in  
5 further detail.

6 The perimeter rails such as side rails 32A, 32B shown in Figure 8, also include a  
7 curved outer surface 64 formed with L-slots 66, 68 receiving mating features on a pair of interfit  
8 plastic trim strips 70, 72 extending to overlie and cover the outer surface of the perimeter rails.

9 The trim strips 70, 72 are preferably of molded plastic of a color matching or compatible with the  
10 vehicle to eliminate any painting of the perimeter rails 32A, 32B. The trim strips 70, 72 could be  
11 made in one piece, but making a separate upper strip 70 makes removal to release the panel 34B  
12 easier and quicker.

13 The trim strip 70 includes a forward section 74 extending over the rear side of the  
14 panel 34A with a down turned lip frictionally engaging the same.

15 The panel 34B is confined by the trim strips 70 but a clearance space at the edges  
16 allows thermal expansion to preclude any resulting distortion, and also allows ready replacement  
17 of the panel 34B.

18 An overlay film 76 can be loose installed overlying the panel 34B and likewise  
19 secured beneath the lip 72. The film 76 is constructed of a color integrated plastic of a matching  
20 color or compatible with the vehicle finish to eliminate the need to paint any of the panels 34A,  
21 B, C. Suitable weather resistant plastics are available for this application such as LEXAN™ and  
22 SLX™ by GE which can provide a class A, OEM compatible appearance in this installation.

1 Film 76 (typically .075-1.5 mm thick) can also be bonded to the panels 34A, B, C.

2 Each of the lower trim strips 72 extends below the bottom edge of the perimeter  
3 rail on which it is installed to complete the covering of the perimeter rails.

4 The perimeter rail sections including rails 32A, 32B have a partially circular  
5 groove 78 into which is fit a top bead 80 of a hollow, readily compressible elastomeric peripheral  
6 seal 82 partially concealed behind the lower part of trim strip 72, seal 82 engaging the sheet  
7 metal of the top of the cargo box wall, to exclude dirt and moisture. The seal 82 is designed to  
8 expand and twist as necessary to constantly maintain contact with the cargo box surfaces as the  
9 truck body flexes in negotiating a roadway, which contact eliminates surface wear which would  
10 otherwise occur by rubbing of the seal 82 thereagainst.

11 The cover 10 is supported spaced above the side walls of the cargo box 60 by the  
12 hinges, and strikers and latches, with the perimeter seal 82 extending about the entire cargo box  
13 perimeter, sealing the intervening space.

14 The seal 82 has hollow spaces 84 forming pleats creating the ready  
15 compressibility thereof as the associated section (12, 14) is tilted up about a hinge, as seen in  
16 Figure 7.

17 Figure 8 shows a side hinged cover section, (here shown as forward cover section  
18 14). A connector-support piece 42 secured to the perimeter rail 32B is formed with a hinge pin  
19 receiving socket in which is inserted a quick release pin 88 which is received in a hinge clevis 89  
20 formed on a hinge strap 90 attached to a second universal mounting bracket 62 clamped to the lip  
21 of the cargo box 60, described in further detail below. The strap 90 attaching bolts are not shown  
22 in Figure 8.

1           The connector-support piece 42 is here also used to connect the perimeter rail 32B  
2 to one end of the cross rail 112 forming one end of the forward cover section 14 by a series of  
3 four bolts 86 having their heads received in downwardly facing tee slots in the crossing rail 112,  
4 similar to what is shown in Figure 12 for crossing rails 98, 94. When used for this purpose, the  
5 connector-support piece extension 43 is angled to match the upward curving crossing rails 112.

6           Figure 9 shows a released latch assembly 48 and striker 58 mounted to a  
7 downwardly angled extension plate 43 of a connector-support piece 42, with the cover section 14  
8 shown in a partially raised position. Removal of the cover section 14 is also readily  
9 accomplished by also removing the quick release hinge pins 88 on the other side wall, as will be  
10 described.

11           Figure 10 shows a lengthwise section through adjacent portions of the forward  
12 cover section 14 and the rear cover section 12, and the fixed center section 16.

13           The rear cover section 12 and forward cover section 14 are both spaced from the  
14 fixed center section 16, and trim-gutter pieces 92 are installed to bridge the gap therebetween.

15           The rear cover section 12 includes the center crossing rail 94A, preferably an  
16 aluminum extrusion, running lengthwise down the center of the framework 12A (Figure 11)  
17 connected to a similarly shaped end crossing rail 98 by means of a bridge piece 100 connected by  
18 bolts 102 received in a tee slot 106 of the main support rail 94, and nuts 104.

19           As shown, the bridge piece 100 has a horizontally projecting tee head feature 108  
20 slid into a corresponding tee slot of the rail 98.

21           The front cover section 14 also includes a center crossing rail 94B connected to a  
22 similarly shaped perimeter rail 112 with a bridging piece 114 joined in a similar manner as the

1 rear cover section 12.

2 A trim strip 116 is mounted in a tee slot 110 extending along each crossing rail  
3 98, 112.

4 Each trim strip 116 has an upper lip 118 which overlies an associated panel 34B  
5 or 34A to nonfixedly secure the same in position atop a respective rail 98, 112 (together with the  
6 outer perimeter trim strips 70).

7 The fixed center cover section 16 similarly includes a crossing rail 120 identical in  
8 configuration to rails 98 and 112 which is fixed to the cargo box side walls with a connector-  
9 mounting bracket (not shown) as is used to mount the striker and hinge components to the cargo  
10 box.

11 The gutter pieces 92 have an integral trim strip portion 122 capturing a narrow  
12 width panel 34C of the same construction as the panels 34A and B.

13 Water drainage holes 124 in each of the strips 116 and 122 allow water to pass  
14 into gutters 92. A stiffer durometer plastic is used for the gutter portions than the strip portions  
15 122.

16 A terminal edge 126 is urged into engagement with an understep of the trim strips  
17 116 just beyond the drain holes 124 to insure that any draining water is captured.

18 The hinge straps 90 are pivoted to a bracket 128 secured to crossing rail 120 by  
19 bolts 130 having their heads captured in a tee slot in the underside of the rail 120, with nuts 132  
20 on the bolt ends protruding through the bottom plate thereof.

21 The hinge straps 90 are secured at their opposite end by interfit tee features 133  
22 and slots 135 in rail 98. Bolt and nut sets are used to locate the straps 90 at any selected position

1 along the rails 98, 120.

2 Figure 11 shows the complete framework for a three section tonneau cover,  
3 providing support for the panels 34A, 34B, 34C, including framework sections 12A, 14A and  
4 16A.

5 Rear section framework 12A includes the pair of side perimeter rails 96A, 96B,  
6 the forward end crossing rail 98 and the rear end perimeter rail 134 connected together at their  
7 meeting ends to form the rectangular framework 12A.

8 The center crossing rail 94A extends lengthwise between the rear end perimeter  
9 rail 134 and the crossing rail 98, which is directly connected at its ends to the midpoint of each of  
10 those rails.

11 The rear end of center crossing rail 94A is connected to the rear end perimeter rail  
12 134 using a connector support piece 42 as described above.

13 A series of smaller width strut rails 136 are connected to the side perimeter rails  
14 96A, B to provide additional support for the panel 34A. The rear perimeter rail 134 is connected  
15 at its ends to a respective rear end of a side perimeter rail 96A, B by a pair of connector pieces  
16 138. More crossing rails and struts could be added to increase the weight carrying capacity of the  
17 top.

18 Figure 12 shows a connection between end crossing rails 112 and 98 to a central  
19 crossing rail 94A, 94B by a connector plate 140, having a tee feature 142 slidably received in a  
20 side facing tee slot 144. The heads of a series of bolts 146 are slidably captured in parallel slots  
21 148 of rail 94A or B and attached to connector plate 140 when nuts 150 are installed.

22 A pair of bolts 152 enter slot 154 of rail 98 and are secured with nuts. Thus, the



1 rails 94A, 98 can be slidably positioned anywhere along the slots 154 but are securely fixed in  
2 any selected position. The rails 94A, 98 can be trimmed to any size adapted to a particular truck  
3 configuration as well as being locatable anywhere along the length of a connected rail to provide  
4 great adaptability to various truck bodies.

5 Figure 13 shows the typical connection of strut rails 136 to central crossing rail  
6 94A.

7 Small connector plates 158 each have a tee feature 160 slidably captured in a side  
8 facing slot 162A or B on the rail 94.

9 Bolts 164 have their heads slidable in a slot 166 in the top of rails 136 with nuts  
10 168.

11 Bolt heads are also preinstalled in top slots 122 of the rail 94A and secured with  
12 nuts to secure the rails 136 in any adjusted position.

13 These connections are typical of the rail connections in framework 12A, 16A.  
14 Crossing rail 120 is connected to the truck cargo box structure by a hinge connection included in  
15 a connector support piece 42 at each end thereof. Corner connector pieces 138 (also shown in  
16 Figure 16) have contoured ends 180 fit beneath respective ends of rails 96B, 134 with bolt holes  
17 182 aligned with holes 184 in the rails to allow installation of pairs of bolts 186 to secure the  
18 corner pieces 138.

19 Forward framework section 14A also includes connector plate pieces 138 and a  
20 perimeter end rail 190 with strut rails 136. The lengthwise crossing-rail 94B is connected at one  
21 end to the forward perimeter rail 190 with a connector-support piece 42, and to crossing rail 112  
22 with a connection as shown in Figure 12.

1           The members of framework sections 12A, 14A, 16A are covered by plastic trim  
2 including the trim strips 70, 72 described above, the trim strips 70, 72 used on each of the  
3 perimeter rails 190, 134, 32A, 32B, 96B, 96B.

4           It is noted that each of the crossing rails 94A, 94B, 112, 120, 198 are purposely  
5 bowed during the extrusion process to provide a crowning of the panels 34A, B, C towards the  
6 sides and the front and rear of the cover 10 in order to shed water. For this reason, the ledge  
7 surfaces 38 of the support-connector pieces 42 may be tipped slightly upwardly to be aligned  
8 with the ends of the curved crossing rails.

9           The universal clamping bracket 62 is shown with a mounted striker assembly 58  
10 in Figures 7 and 14. A main clamping angle 193 has an upper leg 192 extending across the top  
11 of the cargo box side wall 60 and a vertically descending lower leg 194 extending alongside the  
12 downturned cargo box lip 61.

13           An inner clamping angle 196 is arranged on the inside of the cargo box lip 61,  
14 with interposed cushioning members 198, 200 attached to respective clamping angles 190, 196.

15           Each clamping angle 193, 196 has a pair of slots 202, 204, aligned with each other  
16 to allow insertion of a pair of bolts 206 to be secured with cage nuts 206. The slots 202 allow  
17 vertical adjustment of a hinge, striker or gas strut anchor as needed.

18           A series of three spacer strips 208 having holes 210 to receive the bolts 206. The  
19 mounting bracket 62 can thus be mounted vertically to a wide variety of shapes of cargo box side  
20 walls 60.

21           A tee slot 212 is formed on the inside of the vertical portion of the vertical leg 194  
22 of the clamping angle 193.

1           The heads of a pair of bolts 214 are received in the tee slot 212 and pass through  
2 slots in a striker bracket 216, secured with nuts 218.

3           A pair of ears 220 have aligned holes which receive a quick release pin 232  
4 secured with a colter clip 224.

5           A stainless steel sleeve is installed over the hardened steel pin 222 and confined  
6 beneath guide washers 228 and a series of spacer washers 230. Removing or switching sides of  
7 the spacer washers 230 allows adjustment of the axial location of the gap between the guide  
8 washers 228 to proper function with the latching assembly 48.

9           The stainless steel tube 226 rotates against the rotary latch pawls to reduce and  
10 even the wear thereon as the truck is driven, and resists corrosion.

11           The universal clamping bracket 62 can also be used to connect a hinge bracket 90  
12 as shown in Figure 7, allowing a fixed or hinged connection of a perimeter rail 134, 96A, 96B,  
13 32A, 32B or 190 with an end of a crossing rail 94A, 94B, 112, 98 or center rail 120 directly to  
14 the cargo box side wall 60 at any location along the rails or side wall to readily adapt the tonneau  
15 cover to a wide variety of cargo box configurations.

16           In this case, the heads of a pair of bolts 222 (Figure 26) are received in a slot 234  
17 to pass through holes in the upper leg of the clamping angle 193 and through a hinge mounting  
18 strap 236 secured with nuts 240 mounting a removable hinge pin 88 between ears 238.

19           By providing a hinge connection on opposite sides of the center rail 120, the hinge  
20 connection fixes the cover section 16 to the cargo box 60.

21           Figures 24 and 25 show an example of the cargo box mounting system  
22 components for a three section system as shown in Figure 1.

1           The forward cover section 14 is mounted to the cargo box 60 using an extended  
2   length main clamping angle 193A forming a combined universal clamping brackets 62 on each  
3   side which each mounts a striker assembly 58 on one side and hinge brackets 90 on the other side  
4   of the cargo box area to receive the forward cover section 14.

5           Each extended length angle 193A extends further to allow mounting of another  
6   hinge bracket 90 on each side of the cargo box to mount the fixed center cover section 16.

7           This arrangement creates a secure connection of the entire tonneau cover to the  
8   cargo box 60 to create a stable support for all of the components of the cover 10.

9           A gas strut support 242 is provided by a separate clamping bracket 62 on each  
10   side which is stabilized by an extension piece 240 secured to the extended bracket 193A.

11          A pair of striker assemblies 58 are mounted using mounting brackets 62 at the rear  
12   of the cargo box area which is to receive the rear cover section 12.

13          Figure 11 shows partial portions of a pair of gas struts 242 anchored at one end to  
14   a bracket 244 secured to strut rails 136.

15          A single gas strut 246 is connected at one end to a bracket 248 installed on one  
16   side of the rail 112, the other end to a bracket 250 mounted by bolts received in the inside facing  
17   tee slot of the extended length angle 143A.

18          A pair of lock assemblies 252 are mounted to a cover panel 34 and each have a  
19   pair of cables 50 leading to latch assemblies 48.

20          According to the tonneau cover of the present invention, the various rails are  
21   covered with molded plastic trim including the strips 70, 72 installed on all of the perimeter rails  
22   32A, 32B, 96A, 96B, 190 and 134.

1           In addition, trim corners 254 which are fit between the ends of trim strips 70, 72,  
2   secured with upwardly extending screws passing through the connector pieces 138 (Figure 20).  
3   The corners 254 also prevent the trim strips 70, 72 from shifting out of position. Removal of the  
4   corners allows easy removal of strips 70 for replacement of the panels 34.

5           Water seepage which passes by the panel seals 74 is collected in a channel feature  
6   256 in each of the perimeter rails 96A, 96B, 32A, 32B which flows out over the corner pieces  
7   138 and over the outer edge. This also happens to water on the panels 34A, B, C seeping under  
8   the trim strips. The drain path lies outboard of the peripheral seal 82 (Figure 2) to insure that no  
9   water enters the cargo box 60.

10          Figures 18 and 19 show the trim components associated with the center section 16  
11   and the adjacent sides of cover sections 12, 14 on one side of the cover, the opposite side having  
12   the same components.

13          A pair of end pieces 256 are each fit to one end of a perimeter rail 96A, 32A (not  
14   shown in Figure 18), overlapping the trim strips 70, 72, to one side and 116 at the top as well as  
15   the outside side wall of the trim gutter 92 aligned therewith.

16          A collector tray or cup 260 has two channel features which each slidably receive a  
17   respective gutter 92 so that draining water is guided to drip edges 26.

18          A cover 266 is fit atop the collector tray 260.

19          The perimeter skirt seal 82 (Figure 29) extends around the perimeter, installed in  
20   the perimeter rails and corner pieces.

21          As shown in Figure 29, in the region of the center section 16, short seal connector  
22   sections 268 each are positioned at one end of the center rail 120 by plugs 271 inserted in the seal

1 hollows of the ends of the peripheral seal 82. Plugs 271 are compressed against the ends of the  
2 seal section 268 to accommodate movement of the sections 12, 14 while inserting seal continuity  
3 when the sections 12, 14 are closed to finish the complete coverage. A diverter strip 272 funnels  
4 water onto cup 260.

5 That is, the seal sections 268 bridge the gap between the ends of the peripheral  
6 seal 82 held in the perimeter rails.

7 Figure 20 shows an installation with a tool box 274. In this case, the fixed center  
8 section 16 still has two gutters 92 attached, but the rearmost gutter has a butt seal 276 clipped to  
9 the rear gutter wall to bear up against the side of the tool box 274 to create a water seal.

10 Figure 23 show a preferred shape of the seal 82 in which a series of successively  
11 layered hollow accordion pleats 83A, B, C extend from a mounting rib 85. These accommodate  
12 considerable compression and tilting of the seal 82. The bottom of the pleat 83C has a pair of  
13 spaced apart ribs 81 to engage and seal against surface 85. This shape minimizes trapping of dirt  
14 which can scratch the surface 85 if a seal scrubbed against the surface 85. Also, this seal shape  
15 accommodates side to side movement of the cover 10 without breaking contact with the surface,  
16 avoiding wear on the finish.

17 Figure 27 shows the construction of a panel 34. The core 34-1 preferably  
18 comprises a panel of corrugated plastic of the so called S-flute configuration, which has  
19 improved stiffness in a direction transverse to the lengthwise direction over a conventional  
20 parallel flute corrugated plastic panel. This lightweight material, which has good resistance to  
21 impacts, and also provides a greatly increased surface area for improved bonding of the  
22 reinforcing layers when compared to honeycomb cores previously used.

1           Such material is available under the trademark INTEPRO® from Inteplast Group,  
2   Ltd. Of Livingston, New Jersey.

3           Standard corrugated panels could also be used.

4           Additional layers 34-2A, 34-2B of a fiberglass material (FRP) is laminated to each  
5   face of the core 34-1.

6           These layers 34-2A, 34-2B could be smooth or texturized and colored particularly  
7   layer 34-2B.

8           An outer layer 34-3 of a color integrated film overlies the upper laminated layer  
9   34-2A. This film is of a type available in colors matching automotive paints and of a class “A”  
10   quality from GE Plastics under the mark LEXAN® or SLX™ in thicknesses of .075mm to  
11   1.5mm. A loose lay technique is preferred, in which the film 34-3 is trapped beneath the trim  
12   strips but is otherwise not fastened to better present a flat, class A appearance surface.

13           This also allows easy removal of the film for changing colors of for replacement.  
14   Graphic imprints can also be easily incorporated on the film 34-3.

15           Figure 28 illustrates the ease of changing an entire panel 34 or a color film 34-3  
16   by simply sliding out the upper trim strips 70 from the perimeter rails and removing corners 254.

17           One of the lock assemblies 276 is shown in Figure 30, mounted to a panel 34.  
18   Cables 50 are attached to a lock housing 278 by fittings 280 holding the outer cable casing. The  
19   actuation wires 290 extend to a respective end of a swivel bar 282 and are connected thereto.

20           A commercially available lock cylinder 284 is mounted within a can 286 secured  
21   with a lock nut 280. Insertion of a key allows rotation of the bar 282 to pull wires 290 and  
22   release the connected latches 58.

1                   This allows the associated cover section 12 or 14 to be swung up to obtain access  
2 to the cargo box 60.

3                   A glow -in-the-dark plastic key 292 protrudes downwardly from the housing 278  
4 which connected to an extension rod 294 to allow a child to open the latches 58 if he or she is  
5 trapped in the cargo box, providing a safety feature.

6                   A weather cap 296 can be snap fit over the lock face as shown to prevent water  
7 from penetrating the lock and causing freezing, etc.

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